

can be widened by rotating inner cannula 116, outer cannula 152, or both to widen slot 236.

Step 5 is then initiated, whereby RF energy is again allowed to flow to cutting  
5 loop 138, and cutting wire 136 is pushed in lumen 146, which pushes the cutting loop  
through the tissue distal of the loop and toward the distal end of the tissue channel. At  
the end of this cutting stroke, illustrated in Figure 12, cutting loop 138 has formed a  
second, cylindrical cut in the tissue to be sampled. RF generator 106 is then  
deactivated, and cutting loop 138 ceases to cut. The distal end of the cylinder of  
10 tissue cut in step 5 remains attached to the tissue mass in which cannula 102 has been  
inserted.

Step 6 is then performed, by which outer cannula 152 is again rotated relative  
to inner cannula 116 to open the tissue channel to its maximum size. Alternatively,  
15 outer cannula 152 and inner cannula 116 can be counter-rotated away from each other,  
either serially or simultaneously, to open the tissue channel. Rotating both cannulae  
has the advantage of automatically centering the cylindrical tissue sample over the  
tissue channel, which aids in drawing it into the main channel 122. During counter-  
rotation of the cannulae, cutting wire 136 can be slightly rotated, so as not to cut the  
20 tissue sample (yet), or can be held in position, which will result in some planar cutting  
of the tissue sample.

As the tissue channel is widened, vacuum is applied to main lumen 122, which  
draws the cylindrical tissue sample, beginning with the proximal end thereof, into the  
25 main lumen of inner cannula 116. The tissue sample is still connected to the tissue  
mass, as discussed above. Once outer cannula has been rotated to maximize the size  
of the tissue channel, step 7 is commenced. RF energy is again allowed to flow to  
cutting loop 138, and the cutting loop is rotated about axis 148 back into main lumen  
122. As cutting loop 138 is rotated, it performs a third, planar cut in the tissue to be

sampled, at the distal end of the cylinder of tissue formed by the first two cuts. This step is illustrated in Figure 13. Vacuum is applied to main lumen 122, which draws the distal end of the tissue sample, just cut by cutting loop 138's rotation back into the main lumen.

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When cutting loop 138 has been rotated completely back into main lumen 122, illustrated in Figure 14, step 8 can start, in which vacuum continues to be applied to the main lumen, and outer cannula 152 is again rotated to close the tissue channel completely. RF energy is then cut off from cutting loop 138. Because cutting wire 136 is fully within outer cannula 152, the outer cannula can be rotated to completely close the tissue channel, i.e., there is no overlap of cutouts 124, 162. Step 9 is then performed, whereby vacuum is applied to main lumen 122 to draw the cylindrical tissue sample proximally through the main lumen and into tissue collector 114. Cutting wire 136 is then retracted to the proximal end of cutout 124, which completes one cycle. Cannula 102 is then rotated in place about axis 118 so that cutting wire 136 will be adjacent an unsampled volume of tissue, and the cycle is repeated beginning with step 1. These cycles are repeated until cannula 102 has been rotated completely around axis 118, at which time sampling is complete, and cannula 102 can be withdrawn from the patient.

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In accordance with yet another embodiment, system 100 can be used to perform a somewhat different process of obtaining a tissue sample. Table 2 below describes the steps of this latter embodiment, which can be described as a "one-stroke" version of the above-described process, which first process can be described as a "two-stroke" process. By "two-stroke" it is meant that cutting loop makes two trips along its path across the tissue channel: one distally to cut, one proximally to reset at the end of the cycle. In this latter, "one-stroke" embodiment of a process, the proximal return stroke of the cutting loop is utilized as a cutting stroke for a different, adjacent cylinder of tissue.

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TABLE 2

STEP	MODE OF OPERATION	RF ENERGY		VACUUM SOURCE	TISSUE CHANNEL
		TIP	LOOP		
1	Initial entry into tissue until located	ON	OFF	OFF	CLOSED
2	Opening of Tissue Channel	OFF	OFF	OFF	OPENING
3	Deployment of Cutting Wire	OFF	ON	OFF	OPEN
4	Closing of Tissue Channel	OFF	OFF	OFF	CLOSING
5	Distal Cutting of Tissue	OFF	ON	ON	CLOSED
6	Opening of Tissue Channel	OFF	OFF	ON	OPENING
7	Detachment of Tissue	OFF	ON	ON	OPEN
8	Closing of Tissue Channel	OFF	OFF	OFF	CLOSING
9	Retrieval of Tissue Sample	OFF	OFF	ON	CLOSED
10	Rotate Cannula to Next Site	OFF	OFF	OFF	CLOSED
11	Opening tissue channel	OFF	OFF	OFF	OPENING
12	Deployment of Cutting Wire	OFF	ON	OFF	OPEN
13	Closing of Tissue Channel	OFF	ON	OFF	CLOSING
14	Proximal Cutting of Tissue	OFF	ON	ON	CLOSED
15	Opening of Tissue Channel	OFF	OFF	ON	OPENING
16	Detachment of Tissue	OFF	ON	ON	OPEN

Steps 1-9 of the process described in Table 2 are identical to steps 1-9 of the “two-stroke” process. At step 10, cannula 102 is rotated around axis 118 so that the (closed) tissue channel is under an unsampled tissue site. The tissue channel is then opened at step 11, followed by redeploying cutting loop 138 from within cannula 102. Different from the “two-stroke” process described above, the cutting loop has not been repositioned at the opposite end of the tissue channel; instead, the cutting loop remains in the position after the third cut of the previous tissue sample, and essentially “back-tracks” through another tissue site on the subsequent stroke.